

### **III. REMARKS/ARGUMENTS**

#### **A. Status of the Application**

Applicants acknowledge and appreciate the allowance of claims 24-28 in the current Office Action.

In the present response, claims 1, 6, 11, 15, 16, 29, 33 and 34 are amended. Claims 38-48 are added. Thus, claims 1-48 are now pending. Reconsideration of this application in light of the following remarks is respectfully requested.

#### **B. Rejection of Claims 29-32 under 35 U.S.C. § 103(a)**

Claims 29-32 stand rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 6,331,454 to Yamada et al. ("Yamada"). This rejection is respectfully traversed.

To sustain the present rejection of claims 29-32 under 35 U.S.C. § 103(a), a prima facie case of obviousness must be established. MPEP § 2142 provides that a prima facie case of obviousness has three elements. First, there must be some suggestion or motivation, either in the reference or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. Second, there must be a reasonable expectation of success. Finally, the reference must teach or suggest all the claim limitations. In the present case, none of the criteria set forth in MPEP § 2142 have been satisfied with respect to claims 29-32.

As amended herein, claim 29 is drawn to a system for manipulating nanoscale objects. The system includes a passive surface on a substrate, a scanning probe microscope, a mechanism for depositing a plurality of nanoscale objects on the passive surface, a computer readable medium, and a processing unit operable to read the computer readable medium. The computer readable medium stores fabrication design parameters comprising information on selected locations on the passive surface where target positions are to be formed after the deposition of the plurality of nanoscale objects. The target positions identify locations for subsequent placement of nanoscale objects from another location on the passive surface. The computer readable medium also stores control algorithms operable to control operations of the scanning probe microscope. The processing unit operates under the control of the control algorithms and the fabrication design to cause the scanning probe microscope to depassivate sites of the passive surface associated with the target positions and to vertically move nanoscale objects from another position on the passive surface to the target position.

Claims 30-32 each depend directly or indirectly from claim 29, and therefore include at least the foregoing elements.

Yamada describes a process in which a lattice is prepared on a substrate. The lattice is used as a template for the deposition of atoms to form an atomic chain for an atomic circuit. According to the process described in Yamada, the lattice is prepared by removing hydrogen atoms from a hydrogen-terminated silicon surface. (Col. 15, lines 26-27 and Col. 17, lines 17-20.) Magnesium atoms are then deposited where the hydrogen atoms were removed. (Col. 15, lines 27-28). However, Yamada is completely silent as to the location of the magnesium atoms prior to and during the formation of the vacated hydrogen sites. Further, Yamada is completely silent as to providing fabrication design parameters for locations on the passive surface where target positions are to be formed after the deposition of the plurality of nanoscale objects. Further still, Yamada is silent as to the subsequent placement and vertical movement of nanoscale objects from another position on the passive surface to the target position.

In contrast to the description in Yamada, claims 29-32 describe a system in which fabrication design parameters are implemented to provide for the creation of target positions on a passive surface after the deposition of a plurality of nanoscale objects on the passive surface, and for the vertical movement of nanoscale objects from another position on the passive surface to the target position. Thus, as Yamada does not disclose or suggest all of the limitations of claims 29-32, at least one of the required elements of a prima facie case of obviousness has not been met and the prima facie case fails.

Moreover, the remaining elements of a prima facie case have not been met. There is no suggestion or motivation, either in Yamada or in the knowledge generally available to one of ordinary skill in the art, to modify Yamada to arrive at the subject matter of claims 29-32. Without such a suggestion or motivation, there could be no reasonable expectation of success to arrive at the subject matter of claims 29-32. Thus, none of the three requirements of a prima facie case of obviousness has been shown with respect to claims 29-32.

In view of the foregoing, Applicants submit that a prima facie case of obviousness over Yamada has not and cannot be established with respect to claims 29-32. Accordingly, Applicant respectfully requests that the rejection of claims 29-32 under 35 U.S.C. § 103(a) over Yamada be withdrawn.

C. Rejection of Claims 1-3, 6-23 and 3[3]-35 under 35 U.S.C. § 103(a)

Claims 1-3, 6-23 and 3[3]-35 stand rejected under 35 U.S.C. § 103(a) over Yamada and further in view of U.S. Patent No. 4,987,312 to Eigler (“Eigler”). Applicants note that the Office Action refers to claims “3-35” rather than claims “3[3]-35” as stated herein. In view of the indication in the Office Action of the allowability of claims 24-28, and the separate rejection of claims 29-32, Applicants believe that the reference to claims “3-35” is a typographical error and that the correct reference is claims “3[3]-35”. Thus, as applied to claims 1-3, 6-23 and 33-35, this rejection is respectfully traversed.

To sustain the present rejection of claims 1-3, 6-23, and 33-35 under 35 U.S.C. § 103(a), a prima facie case of obviousness must be established. In the present case, none of the criteria set forth in MPEP § 2142 have been satisfied with respect to claims 1-3, 6-23, and 33-35.

1. Claims 1-3 and 6-23

As amended herein, claim 1 is drawn to a method for manipulating a nanoscale object. The method includes depositing a plurality of nanoscale objects onto one or more portions of a passive surface of a substrate and providing a scanning probe microscope having a tip operable to act upon the passive surface. The method further includes forming one or more target positions on the passive surface after the depositing of the plurality of nanoscale objects by causing the tip of the scanning probe microscope to act upon one or more portions of the passive surface where a nanoscale object is not deposited. The method further includes forming a bond between at least one of the nanoscale objects and the scanning probe microscope tip. The bond is a result of at least one of physical and chemical binding forces. The method further includes moving the nanoscale object in an upward direction relative to the plane in which the nanoscale object lies, moving the nanoscale object to one of the target positions, and moving the nanoscale object in a downward direction relative to the plane in which the target position lies. The method further includes forming a bond between the nanoscale object and the target position and breaking the bond between the scanning probe microscope tip and the nanoscale object.

Claims 2, 3 and 6-23 each depend directly or indirectly from claim 1, and therefore include at least the foregoing elements.

Yamada describes a process in which a lattice is prepared on a substrate. The lattice is used as a template for the deposition of atoms to form an atomic chain for an atomic circuit. According to the process described in Yamada, the lattice is prepared by removing hydrogen

atoms from a hydrogen-terminated silicon surface. (Col. 15, lines 26-27 and Col. 17, lines 17-20.) Magnesium atoms are then deposited where the hydrogen atoms were removed. (Col. 15, lines 27-28). However, Yamada is completely silent as to the location of the magnesium atoms prior to and during the formation of the vacated hydrogen sites. Further, Yamada is completely silent as to forming target positions on the passive surface after the deposition of the nanoscale objects. Further still, Yamada is completely silent as to the formation of a chemical or physical bond between a nanoscale object and a scanning probe microscope tip followed by movement of the nanoscale object in upward and downward directions.

Yamada refers to Eigler as the “state of the art” for manipulating atoms, and contains no independent description of methods for the manipulation of atoms. Therefore, the manipulation techniques described by Yamada are at best limited to those described by Eigler.

Eigler describes a method for repositioning an atom on a substrate using an STM. (Abstract.) Eigler is completely devoid, however, of disclosure or suggestion for depositing nanoscale objects on a passive surface, forming a target position at a position on a passive surface after deposition of nanoscale objects on the surface, and forming a chemical or physical bond between a nanoscale object and a scanning probe microscope tip followed by movement of the nanoscale object in an upward and downward direction. Thus, Eigler does not provide the disclosure or suggestion that is lacking in Yamada with respect to claims 1-3 and 6-23.

Neither Yamada nor Eigler, alone or in combination, discloses or suggests all of the limitations of claims 1-3 and 6-23. Therefore, at least one of the required elements of a prima facie case of obviousness has not been met and the prima facie case must fail.

Moreover, the remaining elements of a prima facie case have not been met. There is no suggestion or motivation, either in Yamada or Eigler, in the knowledge generally available to one of ordinary skill in the art, to modify or combine the references to arrive at the subject matter of claims 1-3 and 6-23. Without such a suggestion or motivation, there could be no reasonable expectation of success to arrive at the subject matter of claims 1-3 and 6-23.

Accordingly, Applicants respectfully submit that a prima facie case of obviousness over Yamada in view of Eigler has not been established with respect to claims 1-3 and 6-23.

## 2. Claims 33-35

Claims 33-35 each depend directly or indirectly from claim 29, and therefore include at least the same elements as claim 29.

As amended herein, claim 29 is drawn to a system for manipulating nanoscale objects. The system includes a passive surface on a substrate, a scanning probe microscope, a mechanism for depositing a plurality of nanoscale objects on the passive surface, a computer readable medium, and a processing unit operable to read the computer readable medium. The computer readable medium stores fabrication design parameters comprising information on selected locations on the passive surface where target positions are to be formed after the deposition of the plurality of nanoscale objects. The target positions identify locations for subsequent placement of nanoscale objects from another location on the passive surface. The computer readable medium also stores control algorithms operable to control operations of the scanning probe microscope. The processing unit operates under the control of the control algorithms and the fabrication design to cause the scanning probe microscope to depassivate sites of the passive surface associated with the target positions and to vertically move nanoscale objects from another position on the passive surface to the target position.

As discussed above with respect to the rejection of claims 29-32 over Yamada, Yamada does not disclose or suggest all of the limitations of claim 29, there is no suggestion or motivation to modify Yamada to arrive at the subject matter of claim 29, and there could be no reasonable expectation of success in doing so. Therefore, Yamada cannot support a prima facie case of obviousness of claim 29. Claims 33-35 depend directly or indirectly from claim 29, and therefore Yamada cannot support a prima facie case of obviousness of claims 33-35 for at least the same reasons.

Eigler does not provide the disclosure, motivation or suggestion that is lacking in Yamada with respect to claims 33-35. As discussed above with respect to the rejection of claims 1-3 and 6-23 over Yamada in view of Eigler, the manipulation techniques disclosed in Yamada are limited to those described in Eigler. However, Eigler is completely devoid of a disclosure, motivation or suggestion for the formation of target positions as described in claims 33-35. Thus, Eigler is completely devoid of a disclosure, motivation or suggestion for formation of target sites on a surface after nanoscale objects are deposited on the surface. Further, Eigler is completely devoid of disclosure, motivation or suggestion for parameters corresponding to locations on the passive surface where target positions are to be formed after the deposition of the plurality of nanoscale objects and for the subsequent placement and vertical movement of nanoscale objects from another position on the passive surface to a target position.

Neither Yamada nor Eigler, alone or in combination, discloses or suggests all of the limitations of claims 33-35. Therefore, at least one of the required elements of a prima facie case of obviousness has not been met and the prima facie case fails.

Moreover, the remaining elements of a prima facie case have not been met. There is no suggestion or motivation, either in Yamada or Eigler, in the knowledge generally available to one of ordinary skill in the art, to modify or combine the references to arrive at the subject matter of claims 33-35. Without such a suggestion or motivation, there could be no reasonable expectation of success to arrive at the subject matter of claims 33-35.

Accordingly, Applicants respectfully submit that a prima facie case of obviousness over Yamada in view of Eigler has not been established with respect to claims 33-35.

In view of the foregoing, Applicant submits that a prima facie case of obviousness over Yamada in view of Eigler has not and cannot be established with respect to claims 1-3, 6-23, and 33-35. Accordingly, Applicant respectfully requests that the rejection of claims 1-3, 6-23, and 33-35 under 35 U.S.C. § 103(a) over Yamada in view of Eigler be withdrawn.

D. Rejection of Claims 4, 5, 36 and 37 under 35 U.S.C. § 103(a)

Claims 4, 5, 36 and 37 stand rejected under 35 U.S.C. § 103(a) over Yamada and Eigler, and further in view of an article by Beton et al. entitled "Manipulation of C<sub>60</sub> molecules on a Si surface" ("Beton"). This rejection is respectfully traversed.

To sustain the present rejection of claims 4, 5, 36 and 37 under 35 U.S.C. § 103(a), a prima facie case of obviousness must be established. In the present case, none of the criteria set forth in MPEP § 2142 have been satisfied with respect to independent claims 4, 5, 36 and 37. Therefore, a prima facie case of obviousness has not been established.

1. Claims 4 and 5

Claims 4 and 5 each depend directly or indirectly from claim 1, and therefore include at least the same elements as claim 1.

As discussed above with respect to the rejection of claims 1-3 and 6-23 over Yamada in view of Eigler, neither Yamada nor Eigler discloses or suggests all of the limitations of claim 1. Thus, neither Yamada nor Eigler discloses, motivates or suggest all of the limitations of claims 4 and 5 for at least the same reasons that apply to claim 1.

Beton does not disclose, motivate or suggest the subject matter with respect to claims 4 and 5 that is lacking in Yamada and Eigler. Beton describes a method for manipulating C<sub>60</sub>

molecules on a silicon surface in a  $+x$ ,  $-x$ ,  $+y$ , or  $-y$  direction, where  $x$  and  $y$  are two orthogonal axes. (Beton at p. 1075). Beton does not disclose, motivate or suggest forming target positions on a passive surface after the deposition of a nanoscale object on the surface. Furthermore, Beton does not disclose, motivate or suggest movement of nanoscale objects in an upward and downward direction, and from one location on a surface to a target position on the surface. Further still, Beton is completely silent as to the formation of a chemical or physical bond between a nanoscale object and a scanning probe microscope tip followed by movement of the nanoscale object in upward and downward directions.

None of Yamada, Eigler or Beton, alone or in combination, discloses, motivates or suggests the subject matter of claims 4 and 5. Thus, at least one of the elements of a prima facie of obviousness has not been met and the prima facie case fails. Further, there is no suggestion or motivation to modify or combine Yamada, Eigler and Beton to arrive at the subject matter of claims 4 and 5. Thus, there could be no reasonable expectation of success in doing so.

## 2. Claims 36 and 37

Claims 36 and 37 each depend directly or indirectly from claim 29, and therefore include at least the same elements as claim 29.

As discussed above with respect to the rejection of claims 33-35 over Yamada in view of Eigler, neither Yamada nor Eigler discloses or suggests all of the limitations of claim 29. Thus, neither Yamada nor Eigler discloses, motivates or suggest all of the limitations of claims 36 and 37 for at least the same reasons that apply to claim 29.

Beton does not disclose, motivate or suggest the subject matter with respect to claims 36 and 37 that is lacking in Yamada and Eigler. Beton describes a method for manipulating  $C_{60}$  molecules on a silicon surface in a  $+x$ ,  $-x$ ,  $+y$ , or  $-y$  direction, where  $x$  and  $y$  are two orthogonal axes. (Beton at p. 1075). Beton does not disclose, motivate or suggest forming target positions on a passive surface after the deposition of a nanoscale object on the surface. Furthermore, Beton does not disclose, motivate or suggest vertical movement of nanoscale objects from one location on a surface to a target position on the surface. Further still, Beton does not disclose, motivate or suggest design parameters corresponding to locations on a passive surface where target positions are to be formed after the deposition of the plurality of nanoscale objects and for the subsequent placement and vertical movement of nanoscale objects from another position on the passive surface to a target position.

None of Yamada, Eigler or Beton, alone or in combination, discloses, motivates or suggests the subject matter of claims 36 and 37. Thus, at least one of the elements of a prima facie of obviousness has not been met and the prima facie case fails. Further, there is no suggestion or motivation to modify or combine Yamada, Eigler and Beton to arrive at the subject matter of claims 36 and 37. Thus, there could be no reasonable expectation of success in doing so.

In view of the foregoing, Applicant submits that a prima facie case of obviousness over Yamada, Eigler, and Beton, alone or in combination, has not and cannot be established with respect to claims 4, 5, 36 and 37. Accordingly, Applicant respectfully requests that the rejection of claims 4, 5, 36 and 37 under 35 U.S.C. § 103(a) over Yamada in view of Eigler, and further in view of Beton, be withdrawn.

E. New Claims 38-48

New claims 38-48 include independent claim 38 and claims 39-48, which depend therefrom.

Claim 38 is drawn to a method for manipulating a nanoscale object. The method includes depositing a plurality of nanoscale objects onto one or more portions of a passive surface of a substrate and providing a scanning probe microscope having a tip operable to act upon the passive surface. The method further includes forming one or more target positions on the passive surface by causing the tip of the scanning probe microscope to act upon one or more portions of the passive surface where a nanoscale object is not deposited. The method further includes moving the scanning probe microscope tip into a proximity with at least one of the nanoscale objects sufficient to enable the scanning probe microscope tip to vertically move the nanoscale object in an upward direction relative to the plane in which the nanoscale object lies. The method further includes moving the nanoscale object in an upward direction relative to the plane in which the nanoscale object lies and moving the nanoscale object to one of the target positions. The method further includes moving the nanoscale object in a downward direction relative to the plane in which the target position lies, and into a proximity with the target position sufficient to deposit the nanoscale object at the target position. The nanoscale objects deposited on the passive surface are selected from the group consisting of molecules, dendrimers, macromolecules, viruses, phages, colloids, clusters, nanoparticles and nano-devices.



Claims 39-48 each depend directly or indirectly from claim 38, and therefore include at least the foregoing elements.

None of the art of record discloses, motivates or suggests the subject matter of claims 38-48. None of the art of record discloses, motivates or suggests depositing a plurality of nanoscale objects onto a passive surface of a substrate and forming one or more target positions on the passive surface where a nanoscale object is not deposited. None of the art of record discloses, motivates or suggests moving the nanoscale object in upward and downward directions to a target position. None of the art of record discloses, motivates or suggests depositing and moving a nanoscale object selected from the group consisting of molecules, dendrimers, macro-molecules, viruses, phages, colloids, clusters, nanoparticles and nano-devices.

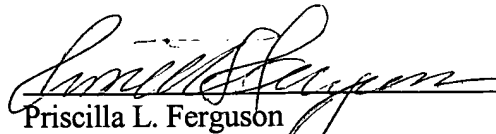
As none of the art of record discloses, motivates or suggest each and every element of claims 39-48, Applicants respectfully submit that any rejections of claims 39-48 under 35 U.S.C. §§ 102 or 103 could not be supported.

### **Conclusion**

Claims 1-48 are now pending in the present application. In view of the foregoing remarks, allowance of claims 1-48 is respectfully requested. The examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

Respectfully submitted,

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